

CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-39^b

July 5, 1977

1. Name of fault: Cucamonga fault.
2. Location of fault: Mt. Baldy, Cucamonga Peak, and Devore Quadrangles, San Bernardino County, California (see figure 1).
3. Reason for evaluation: Located in 1977 study area of the 10-year program for fault evaluation in the state. The Cucamonga fault is classified as "active" by Fife, et al. (1976).
4. List of references:
 - a) Alf, R.M., 1948, A mylonite belt in the southeastern San Gabriel Mountains: Geological Society of America Bulletin, v. 59, p. 1101-1120.
 - b) Burnham, W.L., 1953, The Geology and ground water conditions of the Etiwanda-Fontana area: Masters thesis, Claremont College, 136 p.
 - c) California Department of Water Resources, 1970, Meeting water demands in the Chino-Riverside Area, San Bernardino Company: California Department of Water Resources Bulletin no. 104-3, Appendix A: Water Supply.
 - d) California Division of Mines and Geology, 1974, Special Studies Zones map, Official map, Devore quadrangle.
 - e) Dibblee, T.W., 1968, Displacements on the San Andreas fault system in the San Gabriel, San Bernardino, and San Jacinto Mountains, in Proceedings of the conference on geologic problems of the San Andreas fault system: Stanford University Publication Geological Sciences, v. XI.

- f) Dibblee, T.W., 1958, Geologic map of the Ontario 15' quadrangle,
San Bernardino County: Unpublished map, scale 1:62,500.
- g) Dibblee, T.W., 1963, Geologic map of the San Bernardino 15' quadrangle,
San Bernardino County: Unpublished map, scale 1:62,500.
- h) Dutcher, L.C., and Garrett, A.A., 1963, Geologic and hydrologic
features of the San Bernardino area, California: U.S.
Geological Survey Water-Supply Paper 1419, p.36.
- i) Eckis, R., 1928, Alluvial fans of the Cucamonga district, southern
California in Journal of Geology, v. 36, p. 224-247.
- j) Eckis, R., 1934, South coastal basin investigation: Geology and
ground water storage capacity of valley fill: California
Division of Water Resources, Bulletin 45, 279 p., plates A, B, C.
- k) Fife, D.L., Rodgers, D., Chase, G., Chapman, R., Sprotte, E., 1976,
Geologic hazards in southwestern San Bernardino County:
California Division of Mines and Geology, Special Report 113.
- l) French, J.J., 1966, Progress report on proposed ground water
studies in the Lytle Creek-San Sevaine area, upper Santa Ana
Valley: U.S. Geological Survey, Water Resources Division,
Open File Report.
- m) Hart, E.W., 1977, Personal communication.
- n) Jennings, C.W., 1975, Fault Map of California with locations of
volcanoes, thermal springs, and thermal wells: California
Division of Mines and Geology, California Geologic Data Map
Series, Map no. 1, scale 1:750,000.

- o) Morton, D.M., and Baird, A.K., 1975, Tectonic setting of the San Gabriel Mountains in the San Fernando, California earthquake of 9 February 1971: California Division of Mines and Geology, Bulletin 196, Chapter 1, p. 3-6.
- p) Morton, D.M., 1976, Geologic map of the Cucamonga fault zone between San Antonio Canyon and Cajon Creek, San Gabriel Mountains: U.S. Geological Survey Open File Report 76-726 (1:24,000).
- q) Morton, D.M., 1975, Personal communication.
- r) Real, C., and Cramer, C., 1977, Seismicity near Cucamonga fault, 1974-1976: California Division of Mines and Geology, unpublished maps and memo.

5. Summary of available data:

The Cucamonga fault was first described by Eckis in 1928. He noted the prominent fault line topography across the mouth of Cucamonga Canyon and eastward. Eckis (1934) assigned this fault to one of a system of east-west trending faults along which crystalline rocks of the San Gabriel Mountains have been uplifted above the alluvium of the valley floor. This system of faults has come to be known as a frontal fault system as described by Morton and Baird (1975).

The Cucamonga fault's western terminus is in the vicinity of San Antonio Canyon where it joins (?) the Sierra Madre fault. From here the fault trends eastward for approximately seven miles along the mountain front until it reaches the west side of Day Canyon. Here the fault diverges into a north branch and a south branch. The fault continues eastward as two branches until it appears to be truncated at Lytle Canyon by a branch of the San Jacinto fault system (Burnham, 1953).

The Cucamonga fault is shown by all workers to be a north-dipping, reverse fault; with the exception of Fife, et al. (1976) who indicates oblique slip to be the sense of movement. The measured dip varies from 25 degrees on the west side of Deer Canyon to as steep as 75 degrees on the west side of Day Canyon (Morton, 1976), north side up. The total vertical component of offset along this fault is estimated to range from 1,000 feet west of San Antonio Canyon to nearly 5,000 feet in the eastern portion of the fault (Eckis, 1934, p. 74). Since this offset occurs primarily in basement complex type rocks, a more exact figure relating to offset is difficult to determine. However, the oldest Quaternary surface offset along the fault is displaced about 250 feet (see plate 1b, scarp D).

Traces of the Cucamonga fault, color-coded to show the recency of activity, are shown on plates 1a, b, and c based on the work of Morton (1976). Also on these plates are notes indicating freshness of scarps, scarp descriptions, etc. Some of these descriptions are based on notes Morton (Personal communication, 1975) added to his map. The rest are based on my own brief air photo work. Morton's (1976) work represents the best and most recent mapping of the fault. One reason for this is the large scale of the map (1:24,000) compared with all the other smaller scale maps. Also, Morton's work is the only one to break out Holocene alluvium from the rest of the Quaternary deposits in the area. It was, primarily, this fact that allowed me to classify branches of this fault as Holocene.

I have taken Eckis' (1928) measurements of the height of selected scarps and estimated an age for each alluvial surface to determine recurrence

intervals for fault rupture events. I have also used the scarp on Day Canyon fan (shown in figure 3) in this estimate for recurrence intervals. The other scarps and alluvial surfaces are shown in a sketch by Eckis (1928) shown in figure 2. The results I obtained are shown in table 1. These estimates show two things: 1) Scarp AB and the Day Canyon scarp (the youngest features) indicate the recency of movement (Holocene) along the fault. They do not necessarily indicate recurrence, since they could have originated in a single event, 2) Scarps BC and D (the older features) indicate recurrent movement throughout the Quaternary. They do not indicate any movement along the fault later than late Pleistocene.

Cramer and Real (1977) have plotted the epicenters for seismic events from 1974-1976 (see figure 4). Many of these epicenters lie to the north of the mapped trace of the north-dipping Cucamonga fault. This would suggest that the fault is active. However, these events cannot be uniquely associated with the Cucamonga fault and may be associated with other minor faults to the north.

6. Air photo work:

A brief amount of photo interpretation has thus far been completed with the following results: 1) The accuracy of Morton's (1976) plotting of scarps was determined to be good; 2) the freshness of scarps was determined and the results are plotted on plates 1a, b, c.

7. Field work: None to date.

8. Conclusions:

Nearly all the references listed herein show the Cucamonga fault to offset Holocene age alluvium. In fact, Morton shows only the youngest alluvium (probably no older than 500 years) to be undisturbed by faulting. The fresh appearing condition of many of these scarps on

air photos also leads one to conclude that they are very recent features.

The recurrence intervals I have estimated, though largely conjectural, do indicate the possibility for movement along this fault in the future. Also, the current seismic activity in the area suggests the fault may be active. In general, the fault is well-defined over most of its extent, with the exception of two areas. The area of ~~deer~~ Canyon shows no evidence of faulting on the most recent surface of the fan. The west end of the fault, where it crosses (?) San Antonio Heights, is poorly defined.

9. Recommendations:

That part of the Cucamonga fault which is located on the Devore quadrangle was zoned in 1974. The criteria used for zoning was the fact that it was a Quaternary age fault located on the same quadrangle as the San Andreas and San Jacinto faults. The zoning of these two faults was of primary interest and the zoning of the Cucamonga was secondary. I recommend that the zone be re-evaluated in light of further work by Morton (1976).

I have included on plates 1a, b, and c my preliminary zoning recommendations for the remainder of the Cucamonga fault. Where the zones are shown as dashed lines I am indicating a lack of conclusive data for establishing a zone.

My further recommendations are that the zone areas shown as dashed or uncertain need further photo and field work before a more positive decision can be reached.

10. Investigating geologist's name; date:

Edward J. Bortugno
EDWARD J. BORTUGNO
Geologist
July 5, 1977

I agree with the recommendations that the Cucamonga fault should be zoned and that some additional photo and field work is needed to identify the extent of recent faulting (which controls the locations of zone boundaries). Work should be concentrated in the 2 ungrouped areas. A possible complicating factor is Herport (R. Shertown, P.C. of 7/14/77 who obtained data from L. Herion of Cal Poly) that at least one scarp was trended. A possible fault was trended, but it is not to be checked further. This needs to be checked further. I have not obtained by our own monitoring program.
EJB
7/14/77

Legend (For Plates 1a, b & c) - FER 396 and classification Faults after Morton (1976)



Fault. Solid where accurately located; dashed where approximately located; dotted where concealed; queried where inferred. Hachures indicate fault scarp.



Indicates fault cuts Holocene unit.



Indicates fault cuts Quaternary unit.



Indicates fault cuts Pliocene unit.



Indicates fault cuts a unit older than Pliocene.



Boundary of existing special studies zone (Devore quadrangle only).



Boundary of preliminary special studies zone (Dashed line indicates uncertainty; more work necessary).

by E.J. Bortugno.

Comments are based on air photo interpretation. Photos used are:

Both on file in
AP room

- 1- U.S. Geological Survey, 1966, Black and white photos, GS-VBNF, Flight 1, no. 224-237, scale 1:12,000.
- 2- U.S. Forest Service, 1972, Black and white photos, Flight 0472, no. 217-220, Flight 0572, no. 13-162, scale 1:15,875.



Fig. 2
(From Eckis, 1928)

FIG. 4.—The mouth of Cucamonga Canyon from the southwest, showing about 1½ miles of mountain front. ABCD, fault scarp; 1, 2, 3, alluvial surfaces.

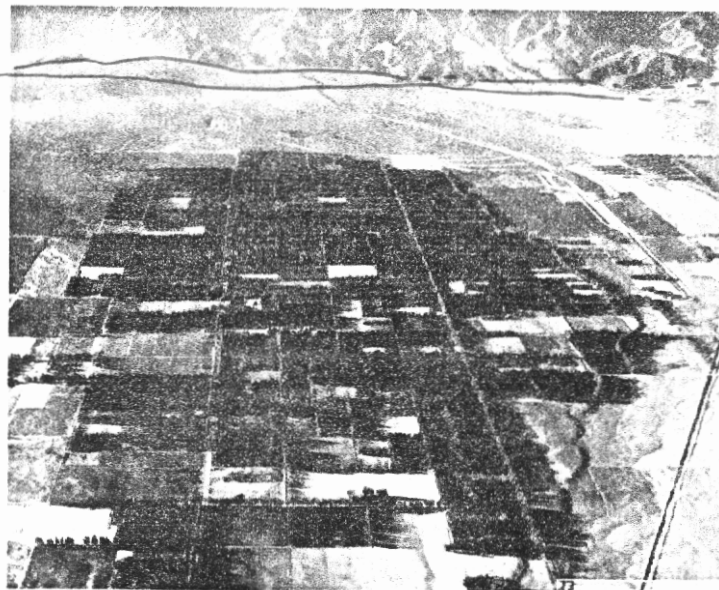
ALSO SEE SKETCH (Fig. 2)

Scarp Name (See Plates 1A, B for location)	Scarp height (feet)	Estimated age of upper alluvial surface faulted (yrs.)	Recurrence intervals (yrs.) for assumed amounts of fault offset per event		
			1 foot	5 feet	10 feet
D	250	2.5×10^6	10,000	50,000	100,000
BC	60	5.0×10^5	8,300	41,500	83,000
AB	10	1.1×10^4	1,100	5,500	11,000
Day Cyn. Scarp	10	1.1×10^4	1,100	5,500	11,000
Avg.			6,467	32,333	64,667

See plate 1B

Table 1. Estimates of recurrence of faulting based on scarp heights and assumed ages of upper alluvial surfaces. Scarp heights and surfaces are based on Eckis (1928) and Morton (1976). Ages are estimated by author. The oldest reasonable age of each alluvial surface was used. However, in the case of the two oldest scarps (D & BC) these assumed ages could be much younger.

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Fig. 3



View of Etiwanda area, looking north. The escarpments of both branches of the Cucamonga Fault show clearly across the mountain front and upper-fan surface.

Day Canyon



Photo from Burnham (1953)
Fig. 9, p. 56.

SEISMICITY NEAR CUCAMONGA FAULT 1974-1976

TRANSVERSE MERCATOR PROJECTION

SCALE = 1/250000

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EXPLANATION

Z	MAG	.EQ.	0.0
⬆	1.0	.LE.	MAG .LE. 1.9
✕	2.0	.LE.	MAG .LE. 2.9
⬆	3.0	.LE.	MAG .LE. 3.9

SEISMICITY NEAR CUCAMONGA FAULT 1974-1976

TRANSVERSE MERCATOR PROJECTION

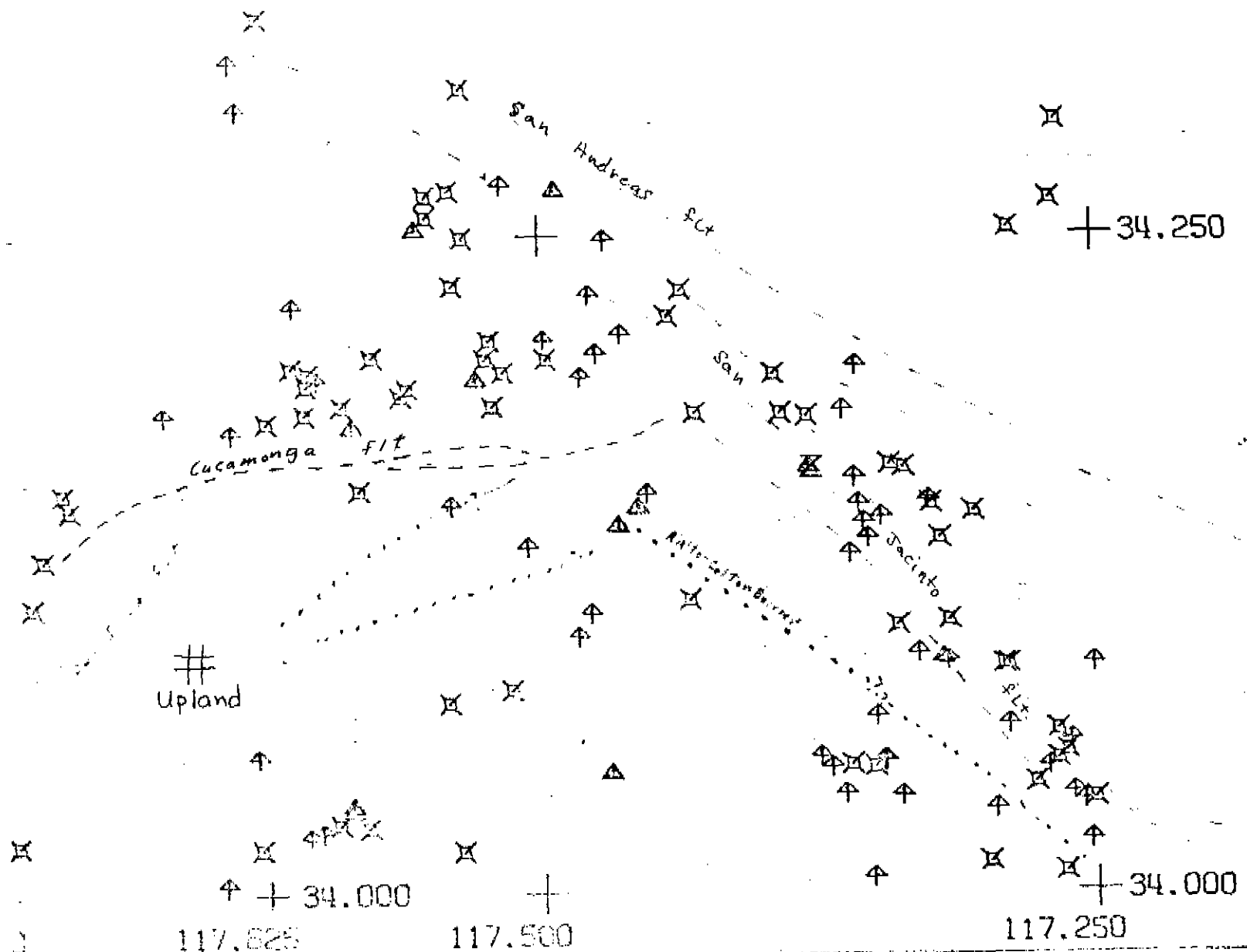
SCALE = 1/250000

From Cramer and Real (1977)

Faults ^{compiled by} ~~from~~ Hart (1977)

EXPLANATION

Z MAG .EQ. 0.0
 + 1.0 .LE. MAG .LE. 1.9
 X 2.0 .LE. MAG .LE. 2.9
 Δ 3.0 .LE. MAG .LE. 3.9



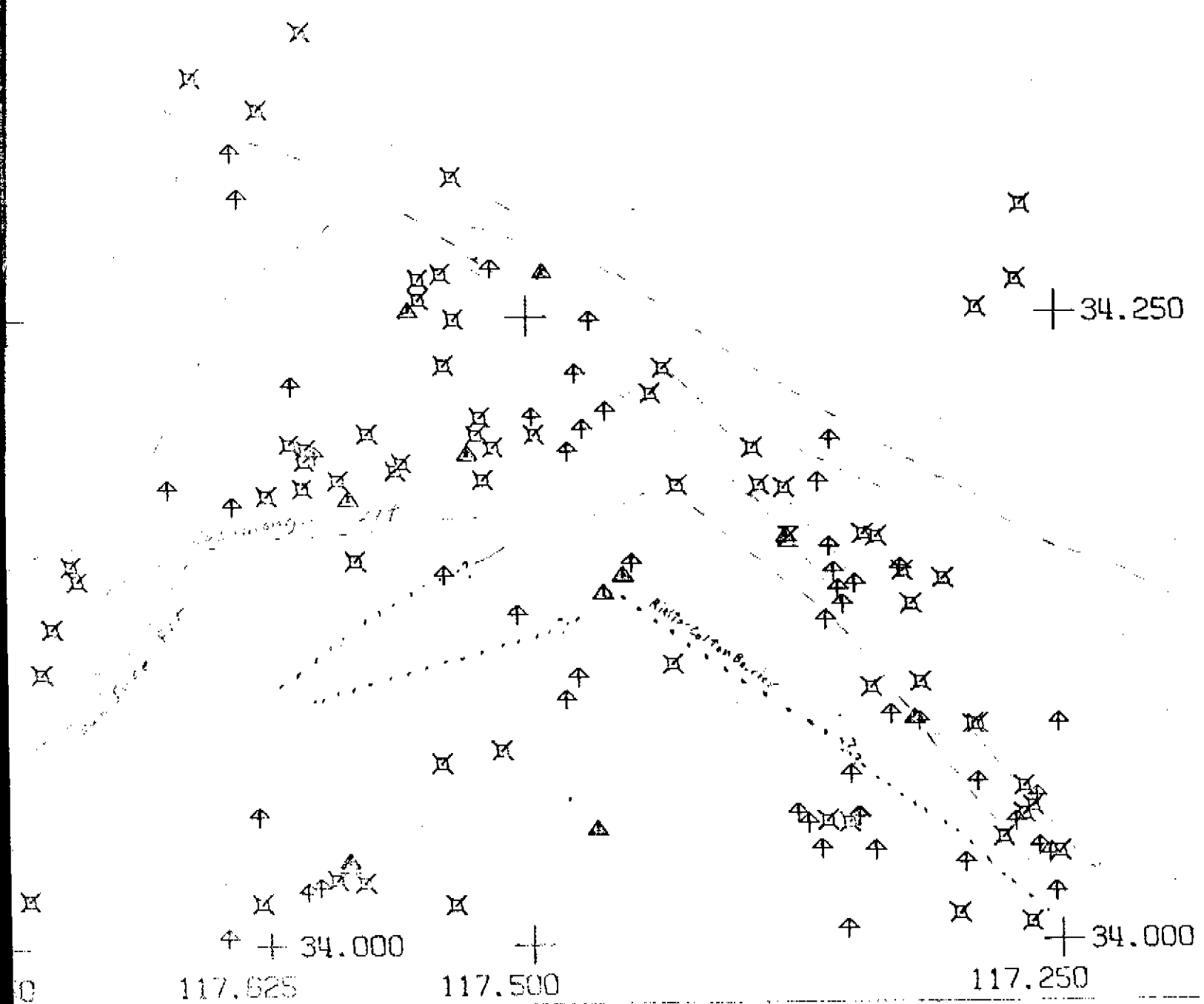
117.625

+ 34.500

+

+ 34.500

117.625



+ + 34.000

+

+

+ 34.000

117.625

117.500

117.250